GEORGIA INSTITUTE OF TECHNOLOGY | OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[X] ORIGINAL [ ] REVISION NO. ______

Project No. A-3740 GTRI/GITx DATE 1/18/84

Project Director: Hank Jackson GA School/Lab TAL

Sponsor: Troup County Historical Society
LaGrange, Georgia

Type Agreement: Letter dated 1/5/84

Award Period: From 1/11/84 To 2/29/84 (Performance) ______ (Reports)

Sponsor Amount:

	This Change	Total to Date
Estimated:	$	$ 1,817
Funded:	$	$ 1,817

Cost Sharing Amount: $ ______ Cost Sharing No: ______

Title: Troup County Archives Building heating and air-conditioning inspection.

ADMINISTRATIVE DATA OCA Contact John W. Burdette X4820

1) Sponsor Technical Contact:

2) Sponsor Admin/Contractual Matters:
Mr. Frank Traylor, Chairman
Building Committee
Troup County Historical Society
P. O. Box 1051
LaGrange, Ga. 30241

Defense Priority Rating: N/A

Military Security Classification: N/A
(or) Company/Industrial Proprietary: N/A

RESTRICTIONS

See Attached -- Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval — Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with none proposed

COMMENTS:

COPIES TO:

Project Director	Procurement/EES Supply Services	GTRI
Research Administrative Network	Research Security Services	Library
Research Property Management	Reports Coordinator (OCA)	Project File
Accounting	Research Communications (2)	Other ______

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 8/17/84

Project No. : A-3740 XXXXX/Lab TAL

Includes Subproject No.(s)

Project Director(s) Hank Jackson GTRI XXXX

Sponsor Troup County Historical Society

Title Troup County Archives Building Heating and Air-Conditioning Inspection

Effective Completion Date: 2/29/84 (Performance) 2/29/84 (Reports)

Grant/Contract Closeout Actions Remaining:

- [ ] None
- [x] Final Invoice or Final Fiscal Report
- [ ] Closing Documents
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

Continues Project No. Continued by Project No.

COPIES TO:

Project Director
Research Administrative Network
Research Property Management
Accounting
Procurement/EES Supply Services
Research Security Services
Reports Coordinator (OCA)
Legal Services

Library
GTRI
Research Communications (2)
Project File
Other I. Newton

Form OCA 60:1028

File Copy

A-3740

Georgia Institute of Technology
ENGINEERING EXPERIMENT STATION
Atlanta, Georgia 30332

February 6, 1984

Mr. Frank Traylor
Troup County Historical Society
Post Office Box 1051
LaGrange, Georgia 30241

Dear Mr. Traylor:

The following is a report on the observations and recommendations of the writer and Mr. Hank Jackson of Georgia Tech EES regarding the HVAC system for the Archives building, based on our visit to the facility on January 25th and 26th, and from subsequent conversations with Mr. Johnny Fletcher of Mingledorf's and Mr. Jack Kemp of Robertshaw Controls. It is our understanding that your dissatisfaction with the HVAC system concerns two major areas: (1) inadequate temperature control, and (2) multiple compressor failures. Several problems and irregularities were discovered during our investigation which have undoubtedly contributed toward these difficulties. It is our opinion that the performance of the system can be substantially improved with the implementation of a number of adjustments, corrections, and minor changes as described in this report.

The multizone system specified for your facility represents a compromise between operating efficiency and close temperature control. This type of system is very good at maintaining close temperature control in buildings with areas which vary widely in heating and cooling load profiles; however, it is not considered to be a particularly energy efficient design. The requirement that you stated for close humidity control in the stack storage area is not effectively addressed by this system, which includes humidification for maintenance of a minimum humidity level, but no positive means of limiting maximum humidity within the space. During the summer months, it is possible that the relative humidity in this area will reach 60% or more under normal conditions. In retrospect, it would be desirable to have provided a separate system for this sensitive area, with both humidification and reheat for close humidity control.

The multiple compressor failures that you have experienced represent a very complex issue; however, we feel that these problems for the most part have been resolved. The first failure can be attributed to construction problems, primarily due to expansion valves which were damaged during installation. The third failure was evidently the result of the center power conductor coming loose at the disconnect switch, causing the unit to operate on single phase rather than three phase current. The second failure is the most difficult to identify as to cause, but can be generally attributed to abnormal operating conditions causing internal safety controls to shut off the unit until it was manually reset. The failure of the contractor to correct the abnormal conditions causing the lock-out of the compressor, rather than simply resetting the safety control, ultimately led to the failure of the compressor. Additional remedial actions taken at the time of replacement of this compressor hopefully have corrected the abnormal operating conditions. Should trip-out of the compressor recur at any time in the future, the cause should be determined and corrected as quickly as possible, rather than resetting the safety control as a matter of course.

The following conditions were observed to be contributing to the difficulties experienced:

1. Zones 5 and 10 were found to be mislabeled at the multizone unit. The zone #5 thermostat, located in the meeting room, was found to be controlling the zone damper serving zone #10 (directors office). The thermostat in the directors office was actually controlling zones 5 (meeting room), 2 (AV room), and 3 (workroom).

2. The combination of several of the original 11 zones, reducing the current number of zones to 6, is resulting in uneven temperature control in areas that are no longer under the control of their respective thermostats. Although zones with similar load profiles were combined, which should theoretically provide reasonably accurate temperature control, in actual practice this is not the case. A given control signal to 2 or more zones that are combined does not produce equal temperatures in the individual zone ducts. This is due to variations in adjustment of damper linkages and airflow within the multizone unit, and in hot and cold deck temperatures along the lengths of each deck. In our opinion, the reduction in the number of zones is an unnecessary and undesirable compromise of the flexibiity of the original system.

3. Several zone dampers were found to be attempting to drive beyond the full cooling position, causing the drive linkage to bind and in some cases stick in the full cooling position. It was later learned from conversations with Mr. Jack Kemp of Robertshaw that zone dampers had been intentionally adjusted in this manner to prevent them from fully closing off to the cold deck, in order to maintain a minimum air flow across the cooling coil. This condition can cause overcooling in some zones unless hot deck temperature is sufficiently high to overcome airflow from the cold deck. This condition effectively requires boiler operation during all but the warmest weather conditions.

4. The automatic control drawings specify a throttling range of 10°F for the room thermostats. This means that room temperature could vary as much as 10°F between maximum heating and cooling conditions.

5. The cold deck temperature transmitter is located very close to the hot deck and is being affected by cross-over from the hot deck, resulting in erroneously high temperature readings. A temperature of 90°F was recorded at the sensor location on the first day of our inspection (condensing unit off, return air temperature 74°F). The sensing bulb is also very short (approximately 12 inches), resulting in temperature indication that is not felt to be representative of average cold deck temperature. A different type of temperature transmitter, with an averaging bulb approximately 10 feet long that would sense a true average deck temperature, would be preferable for both hot and cold decks; however, it is probably not possible to install this type of device at the present time.

6. A similar condition exists with the hot deck temperature controller, its location also causing it to indicate higher than actual hot deck temperature.

7. The mezzanine area (zone 8) is not receiving adequate cooling, apparently as a result of a problem with the zone damper or with airflow within the multizone unit. With the zone damper manually opened to the cold deck and actual cold deck temperature at approximately 57°F, supply air to the space never dropped below 72°F.

8. The system is in need of re-balancing of the air distribution system. Several air outlets were found to have little or no perceptible air flow.

9. The two supply air grilles on the south wall of the meeting room are covered by the projection screen when it is lowered into position, preventing proper air flow to the space.

10. Humidity recordings for the stack room over a one week interval indicate an exessive deviation in humidity level. This is likely to be a result of the misadjustment of the humidification control system or a malfunction of the humidifier itself.

The following are our recommendations for specific correctional action:

1. Restore all eleven zones to full operational status, and correct cross-up of zones 5 and 10.

2. Adjust zone damper linkages for full travel without bind-up at either end of travel.

3. Replace zone thermostats with units having a maximum throttling range of 3°F, if this degree of control is not obtainable with existing thermostats.

4. Correct operation of zone #8 mixing damper. This may require installation of an access panel in the zone duct. (Access panels in all zone ducts would be a desirable, but not essential, addition.)

5. Re-balance air distribution system to provide specified air quantities. This may require replacing the existing 10 hp supply fan motor with a 15 hp motor and/or a change in drive pulley in order to obtain the specified total air flow.

6. Relocate supply air outlets on south wall of meeting room to floor level, and replace grilles with similar units designed for upward deflection. Also desirable, but not essential, would be the relocation of the zone 5 thermostat to the opposite side of the folding partition, approximately centered along the east wall.

7. Replace cold deck temperature transmitter with averaging bulb type or relocate existing unit to approximately mid-height of the cooling coil, centered on the outlet end of the air handling unit.

8. Replace hot deck temperature transmitter with averaging bulb type or relocate existing unit to a location centered on the top of the air handling unit if possible, or if not possible, then replace transmitter with a similar unit with at least 36 inch bulb length.

9. Modify hot deck temperature control scheme from current zone demand reset to reset from outside air temperature, according to the following schedule:

Outside Air Temp.	Hot Deck Temp.
10	120
60	80

10. Verify proper operation of cold deck temperature control system, retaining setpoint temperature reset from zone demand. Adjust and calibrate all control instruments.

11. Reinstate control to lock out condensing unit when ambient temperature falls below approximately 40°F. Optimum adjustment of this control will have to be determined by operating experience, and should be set at the highest possible temperature that will maintain space temperatures within normal limits.

12. Install air pressure gauges in signal lines from all room thermostats, receiver controllers, and E/P switches to facilitate system monitoring and check-out.

13. Check out operation of humidifier and calibration of humidistat.

14. Shut down steam boiler during summer months. This should present no problems with space temperature control once items 1, 2, 8 and 9 above have been accomplished. The boiler will not be available to provide steam for the humidifier serving the stack room during this period; however, there may well be no need for humidification during this time due to ambient conditions. If minimum humidity levels cannot be maintained under these conditions, then the purchase of a separate self-contained humidifier is recommended to serve this area.

In our opinion, the above changes will result in substantially improved system performance. Since some of these changes could impact the operation of the condensing unit, we suggest that the endorsement of Carrier Corp. be obtained before implementing them. We will be happy to meet with you, the Historical Society staff, your engineers, contractors and any other interested parties to review and discuss our recommendations and to determine a proper plan of action.

Sincerely,

Douglas M. Moore, P.E.
Research Engineer II

mro

cc: Ms. Faye Bruce